Biogeosciences Discuss., 9, C1590–C1593, 2012
www.biogeosciences-discuss.net/9/C1590/2012/

Biogeosciences
Discussions

Interactive comment on "An assessment of the carbon balance of arctic tundra: comparisons among observations, process models, and atmospheric inversions" *by* A. D. McGuire et al.

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Received and published: 31 May 2012

This is a nice overview paper of the carbon balance of tundra. Th conclusion is that from eddy covariance observations the tundra represents a neutral carbon balance, that process model indicate a weak sink, albeit with large uncertainty. They further use estimates from inversion models to obtain an overall estimate of the tundra carbon balance that indicates a small sink for CO2 and a source of CH4, with the sink increasing from the 1990s to 2000s and the CH4 source increasing. I am very impressed by the eddy covariance compilation, this is something I always love to see, and this one is particularly useful and comprehensive. Overall this is a well written, accurate state of

the art overview that should be published with some minor revisions.

My main comment is that, although a considerable amount of tools are used to derive the overall balance, there is little deliberation on the causes of the sink increase from the 1990s to the 2000s, other than the mentioning of a 0.6 C temperature increase. It would greatly strengthen the paper if some more though and discussion were devoted to this issue. I would suggest a more in depth analysis of the process model results would help here (for instance the difference listed on page 4552 lines 7-11).

In general. It is hard to specify precisely how to present the results of different models. I would take care however to simply average them. Giving the mean, modus and range is maybe a better way. There is no a priori reason to use a Gaussian mean and standard deviation. The minimum would be to explain the choices made.

Specific comments

Page 4546 line 25. I would suggest to include references to Ringeval, et al (2010) and Petrescu et al (201o) that highlight in particular the key concerns in CH4 modelling in the arctic and wetlands.

Page 4548. It would be worth mentioning that several successful campaigns have been execute to derive eddy covariance fluxes of CH4 here. They are mentioned in the appendix and compilation, but the emphasis here is very much on chambers, and this is not quite reflecting the state of the art (and future...).

Page 4553. In general it is not clear to me how confidence limits are derived. Do they represent 1, 2 standard deviations, other? Please clarify.

Page 4554. Please be aware of the sign conventions or rephrase. A sink is negative, a source positive.

Page 4555. line 15. Is there any indication whether the larger uncertainty in the 2000s is just due to a larger number of sites. Would it be possible to compare the same sites only, to avoid this spurious uncertainty?

Page 4557-4558 seasonal cycle. I cannot but find this paragraph rather lackluster and almost trivial. What do we really learn from this?

Page 4560. I though the analysis did not use Carbontracker. Why is used here?

Page 4562 lines 2-3. As NPP and RH are the major fluxes in the carbon balance, this conclusion should be hardly surprising. Are you saying that you cannot really tell in more detail what is going to happen?

Page 4564 line 24. the study of Parmentier et al (JGR, 2011) present a good experimental analyze and would need to be cited here. The real issue is what the relative sensitivity of NPP and RH are for an earlier growing season and a longer autumn.

Page 4566. I would challenge the authors to prioritize their wish list. With limited funding, would you invest in a few more well equipped eddy covariance sites, or would you spend your money on further improving inversion models. The improvement of the latter may be less required also, as near the poles the grids become smaller and in fact, more stations are available for a smaller are that say, in the tropics.

References

Parmentier, F. J. W., M. K. van der Molen, J. van Huissteden, S. A. Karsanaev, A. V. Kononov, D. A. Suzdalov, T. C. Maximov, and A. J. Dolman (2011), Longer growing seasons do not increase net carbon uptake in the northeastern Siberian tundra, J. Geophys. Res., 116, G04013, doi:10.1029/2011JG001653. Petrescu, A. M. R., L. P. H. van Beek, J. van Huissteden, C. Prigent, T. Sachs, C. A. R. Corradi, F. J. W. Parmentier, and A. J. Dolman (2010), Modeling regional to global CH4 emissions of boreal and arctic wetlands, Global Biogeochem. Cycles, 24, GB4009, doi:10.1029/2009GB003610.

Ringeval, B., N. de NobletâĂŘDucoudré, P. Ciais, P. Bousquet, C. Prigent, F. Papa, and W. B. Rossow (2010), An attempt to quantify the impact of changes in wetland extent on methane emissions on the seasonal and interannual time scales, Global Biogeochem. Cycles, 24, GB2003, doi:10.1029/2008GB003354.

Interactive comment on Biogeosciences Discuss., 9, 4543, 2012.